

Seasonal and Non-Seasonal Variations of Jupiter's Atmosphere from Observations of Thermal Emission, 1994-2011.

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We analyzed mid-infrared images of Jupiter's thermal emission, covering ~ 1.5 Jovian years, acquired in discrete filters between 7.8 and 24.5 μm . The behavior of stratospheric (~ 10 -mbar) and tropospheric (~ 100 -400 mbar) temperatures is generally consistent with predictions of seasonal variability, with differences between 100-mbar temperatures ± 50 - 60° from the equator on the order of ± 2 . Removing this effect, there appear to be long-term quasi-periodic variability of tropospheric temperatures, whose amplitude, phase and period depend on latitude. The behavior of temperatures in the Equatorial Zone (EZ) suggests a ~ 4 -6-year period with amplitude of about ± 1 -1.5 K in temperature. At mid-latitudes, the periodicity is more distinct with amplitudes around ± 1.5 -2.5 K and 4-8 year periods. The 4.2-year variation of stratospheric temperatures known as the quasi-quadrennial oscillation or "QQO" (Leovy et al. 1991, Nature 354, 380) continued during this period. There were no variations of zonal mean temperatures associated with any of the "global upheaval" events that have produced dramatic changes of Jupiter's visible appearance and cloud cover, although there are colder discrete regions associated with updrafts, e.g. the early stages of the re-darkening ("revival") of the South Equatorial Belt (SEB) in late 2010. On the other hand increases in the visible albedos ("fades") of belts are accompanied by increases in the thickness of a 700-mbar cloud layer (most likely NH_3 ice) and clouds at higher pressures, together with the mixing ratio of NH_3 gas near 400 mbar (above its condensation level). These quantities decrease during re-darkening ("revival") episodes, during which we note discrete features that are exceptions to the general correlation between dark albedos and minimal cloudiness. In contrast to all these changes, the meridional distribution of the 240-mbar para- H_2 fraction appears to be invariant in time.